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Title: Moore ME Feb 18 2019 aerosol class for Northern NM College

Author(s): Moore, Murray E.

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Moore ME Feb 18 2019 aerosol class for Northern NM College

Murray E. Moore, PhD, PE
Los Alamos National Laboratory
Feb. 18, 2020

From: Scott Braley <scott.braley@nnmc.edu>
Date: Monday, Feb 10, 2020, 1:54 PM
To: Moore, Murray E <memoore@lanl.gov>
Subject: [EXTERNAL] Re: Moore 2018 Radioactive aerosols training LAUR-18-23531 class.pdf

I'll cover generalities of different types of air sampling instruments, and also discuss particle sizes and the importance of AMAD to different parts of the lung. For your talk I'm thinking a bit more detail about the specific sampler you're bringing, and the types in use at LANL, then setup and ops check, loading and removing a filter, cutting out the right size circle, reading the sample (we have a couple Eberline SAC-4s and Ludlum 2929s here), and radon/daughters corrections.

They've previously had lectures on different types of detectors, but we haven't talked about air sampling. My talks this week will (hopefully) cover the basics.

Thanks a lot!
Scott

G. Scott Braley
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505.747.5469

The Bladewerx SabreAlert3™ is a lightweight, battery powered, alpha air monitor that can be used as a portable workplace monitor or a portable CAM (continuous air monitor) for emergency response assessments.

Los Alamos air sampler.

Los Alamos AIRNET sampler: CF-5624-WR

* Weather Proof Enclosure
* Omni-Directional Inlet

- Automatic Flow Control
- Stop Timers and Flow Totalizer
- Low Current Draw

to Minimize Solar Power Requirements

* For Continuous Use

Specifications

Motor/Pump:	24 Volt DC, 1.5 Amp Max Amp Draw, Brushless Blower, Max VAC:24" H2O
Unit Weight:	10 lbs. (without battery)
Housing:	13" x 13" x 13" White Powder Coated Aluminum Cabinet
Inlet:	Anodized Aluminum Omni-Directional, Weather Proof
Max Flow Rate:	4.5 CFM (w/ FP1441-102, 4" Dia.) 2.5 CFM (w/ FP5211-20, 2" Dia.)
Filter Holders & Adapters:	Unit includes 4" filter holder Use WRA-4CF adapter for CF-Series holders
Flow Calibrator:	HFC-XX-S (Special low pressure drop calibrator, XX is maximum flow rate)
Filter Paper:	See Filter Paper for Air Sampling

TISCH Environmental

OPERATIONS MANUAL

TE-5170 Total Suspended Particulate
Mass Flow Controlled
High Volume Air Sampler

Tisch Environmental, Inc.
145 South Miami Avenue
Village of Cleves, Ohio 45002

Toll Free: (877) 263 -7610 (TSP AND-PM10)
Direct: (513) 467-9000
FAX: (513) 467-9009

sales@tisch-env.com
www.tisch-env.com

UN

TE-5170 Mass Flow Controlled Total Suspended Particulate High Volume Air Sampler

www.tisch-env.com

(1) Aluminum shelter
(2) Blower motor
(3) Filter holder
(4) Airflow & pressure recorder
(5) Mass flow controller
(6) Mechanical timer
(7) Elapsed time indicator.

Applications

- Ambient air monitoring to determine mass concentration of suspended particulate levels relative to air quality standards. This result is reported in micrograms per cubic meter ($\mu g/m^3$).

- Impact of a specific source on ambient levels of suspended particulates by incorporating a "wind-direction-activation" modification which permits the sampler to operate only when conditions are such that a source-receptor relationship exists.

Filter holder
for 8 inch by 10 inch
filter paper

Blower motor

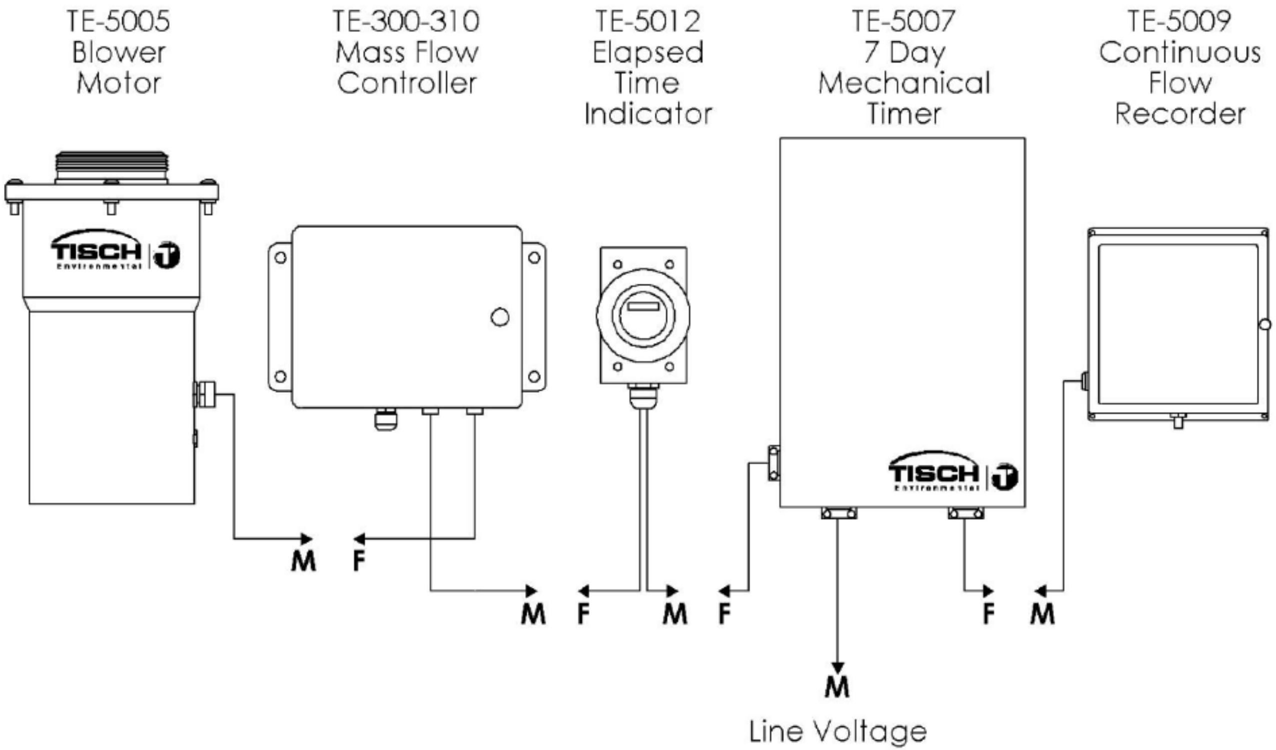
7 day timer

Airflow controller

Elapsed time indicator

Electrical Set-Up

TE-5170 Electrical Set-Up



How is air flow measured?

Air flow:
Cubic feet per minute (CFM) and meters cubed per minute (m3/min).

Pressure drop:
Not pounds per square inch (PSI) but inches of water column (H2O (in) or inWC).

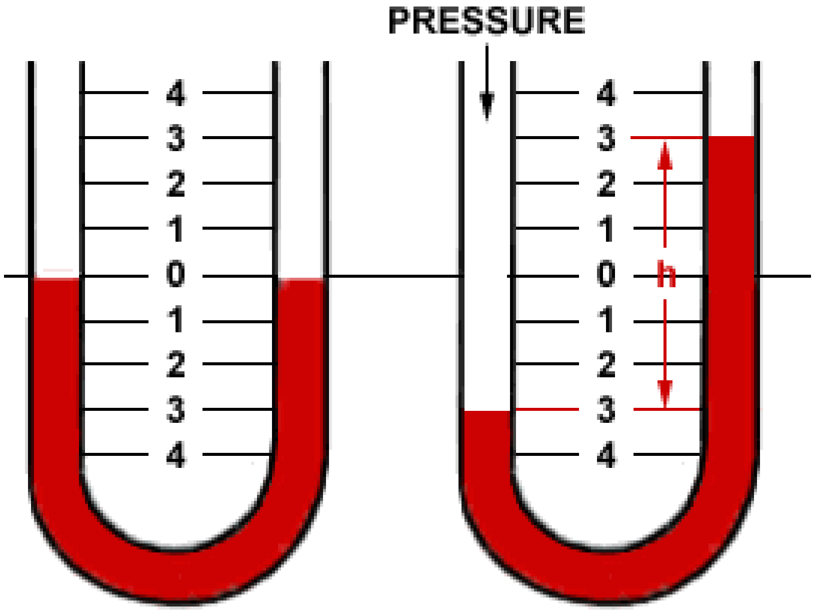


Fig. 2-1 Fig. 2-2

Figure from Dwyer Instruments Inc.

But what's the difference between low altitude breathing and high altitude?

Less air (less oxygen) at higher altitude.

"Standard pressure and flow" is defined at sea level.

"Ambient pressure and flow" is defined at local conditions.

Orifice calibrator

Sample calibration certificate of the orifice plate from Tisch Inc.

)-Manual Tisch TSP.pdf - Adobe Acrobat Pro DC

View Window Help

Tools Document 40 / 40

TISCH Environmenta

ibrator Certificate

TISCH Environmental

TISCH ENVIRONMENTAL, INC.
145 SOUTH MIAMI AVE
VILLAGE OF CLEVES, OH
45002
513.467.9000
877.263.7610 TOLL FREE
513.467.9009 FAX

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5028A

Date - Oct 24, 2014 Rootsmeter S/N 9833620 Ta (K) - 296
Operator Tisch Orifice I.D. - 2978 Pa (mm) - 755.65

PLATE OR VDC #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER DIFF Hg (mm)	ORFICE DIFF H2O (in.)
1	NA	NA	1.00	1.1880	4.5	1.50
2	NA	NA	1.00	0.9230	7.5	2.50
3	NA	NA	1.00	0.8380	9.0	3.00
4	NA	NA	1.00	0.7790	10.5	3.50
5	NA	NA	1.00	0.5860	18.0	6.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)		Va	(x axis) Qa	(y axis)
0.9950	0.8375	1.2254		0.9940	0.8367	0.7665
0.9910	1.0737	1.5819		0.9901	1.0727	0.9896
0.9891	1.1803	1.7329		0.9881	1.1791	1.0840
0.9871	1.2671	1.8718		0.9861	1.2659	1.1709
0.9771	1.6674	2.4507		0.9761	1.6657	1.5331

Qstd slope (m) = 1.47574		Qa slope (m) = 0.92408
intercept (b) = -0.00613		intercept (b) = -0.00383
coefficient (r) = 0.99985		coefficient (r) = 0.99985
y axis = SQRT[H2O(Pa/760)(298/Ta)]		y axis = SQRT[H2O(Ta/Pa)]

CALCULATIONS

Vstd = Diff. Vol[(Pa-Diff. Hg)/760](298/Ta)
Qstd = Vstd/Time

Va = Diff Vol [(Pa-Diff Hg)/Pa]
Qa = Va/Time

For subsequent flow rate calculations:

Qstd = 1/m{[SQRT(H2O(Pa/760)(298/Ta))]- b}
Qa = 1/m{[SQRT H2O(Ta/Pa)]- b}

11.00 in

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UNCLASSIFIED

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coefficient (r) =		0.99985		coefficient (r) =		0.99985
y axis = SQRT[H2O(Pa/760)(298/Ta)]				y axis = SQRT[H2O(Ta/Pa)]		

Qstd = flow rate measured at sea level

Qa = flow at the local ambient condition

CALCULATIONS

Vstd = Diff. Vol[(Pa-Diff. Hg)/760](298/Ta)
Qstd = Vstd/Time

Va = Diff Vol [(Pa-Diff Hg)/Pa]
Qa = Va/Time

For subsequent flow rate calculations:

Qstd = 1/m{[SQRT(H2O(Pa/760)(298/Ta))]- b}
Qa = 1/m{[SQRT H2O(Ta/Pa)]- b}

Ps=760 mmHg

and

Ts=298 degK

Pressure and temperature ratios: Pa/Ps and Ts/Ta
S="standard" and a="ambient"

EPA Approved Inlets (Low air flowrate)

- **PM10 McFarland SSI**

  Sierra/Andersen SA246b (Right)

  Wedding (Bell Shaped Cyclone/Not Pictured)

  'Subpart D' Test Reports, 1983

- **PM10 EPA Inlet**

  CFR, Part 50 Appendix L 1997

  Pre-Selector for PM2.5 (Left)

  Tolocka et. al Paper, AS&T

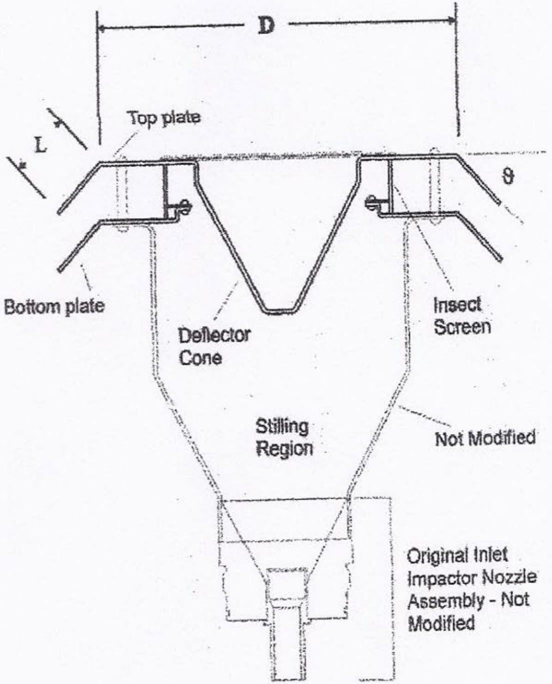
  (No 'Subpart D' Test-Report)

From: Merrifield T 2014

1996 EPA Modified PM10 Inlet

MODIFICATIONS

- **Enlarged Water Drain-Hole**
- **“Pie-Pan” 45° Top & Bottom Inlet Plates**
- **Insect Screen Standardized**



Wind tunnel tests were performed at 24 km/h for fine particle aspiration and at 2, 8, and 24 km/h for coarse particle sampling characteristics of the modified design.

The laboratory evaluations of this inlet for fine (PM2.5) and coarse (PM10) particle sampling demonstrated that the aspiration characteristics of this inlet were identical to those of the original inlet.

Tolocka et al 2001

END